Meeting Report: NeuroFrance 2023 Melina Vladisauskas
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The NeuroFrance meeting was a highly motivating and enriching event. Ranging from the latest studies on neocortex development and the impact of early adversity to a fantastic symposium on NeuroArcheology, the conference provided a comprehensive update on diverse neuroscience fields. Notably, Matthew Rushworth's and Franck Polleux's captivating talks on the social brain and prefrontal cortex showcased the conference's commitment to exploring novel frontiers. Held in Lyon, NeuroFrance 2023 proved to be an outstanding platform for sharing cutting-edge research and advancements across the entire spectrum of neuroscience. The following paragraphs include central highlights from some of the topics covered in the meeting.

To start, Franck Polleux delivered a captivating talk on the development of cortical circuits and the genetic factors that contribute to human uniqueness. His research focused on identifying genetic markers exclusive to humans and investigating their relationship to neocortex development. One particular gene of interest was SLIT–ROBO Rho GTPase-activating protein 2 (SRGAP2), which plays a crucial role in cortical circuit assembly and function. The ancestral form of this gene, SRGAP2A, is highly conserved among all mammals. However, through a series of large segmental duplications, two partial duplicates emerged: SRGAP2B and SRGAP2C, with SRGAP2C originating approximately 2.4 million years ago at the advent of the Homo lineage. SRGAP2C has shown strong positive selection and is present in a highly conserved copy number among human populations.

Studies have demonstrated that SRGAP2A promotes the maturation of excitatory and inhibitory synapses in cortical pyramidal neurons while limiting the total number of synapses formed by cortical layer 5 and layer 2/3 pyramidal neurons. On the other hand, SRGAP2C, which encodes a truncated protein that inhibits the functions of SRGAP2A, leads to delayed synaptic maturation and an increased density of synapses, mimicking features found in human pyramidal neurons. These findings suggest that the emergence of SRGAP2C has played a role in shaping the unique structural and functional characteristics of cortical circuits in the human brain. By

unraveling the genetic factors involved in neocortex development, Franck Polleux's research contributes to our understanding of the evolutionary changes that have contributed to the cognitive abilities and distinct features of the human brain.

The symposium on early experiences and adversity on brain development in human and nonhuman primates was remarkable. The talks given by researchers addressed the topic from different angles: Chiara Turati (Social touch and social exclusion affect infants' behavior and neural processing), Pier Francesco Ferrari (Early social adversity in non-human primates affects negative attentional biases and amygdalo-cortical functional connectivity), Petra Huppi (Brain maturation and processing of sounds and voice in preterm infants), Ross Vanderwert (Assessing brain function and structure as a result of early adversity) and Cédric Girard-Buttoz (Maternal effects on physiological stress and communication in wild chimpanzees).

Dr Turati described how infants are tuned to social signals such as faces and gaze, and showed her group's work on the ball-tossing paradigm. In this experimental setting, they model an ostracism condition as a negative trait and a social touch condition as a positive one. Along with EEG recordings, they found that the negative condition elicited a faster perception of happy faces and the opposite for the included group at 3 months of age. Furthermore, at 11 months of age they are also able to distinguish painful gestures from gentle, suggesting that the encoding of this social cues can be a potential modulator of brain development.

Building on the previous idea, Dr Ferrari described the results of the "Lyon longitudinal study" (LyLo) aimed to study the early psychosocial deprivation effects on brain and behavior in macaques. Results indicated that the effect of the manipulation on the sensitive period (childhood) included an increased fear and anxiety, a poorer development of executive functions and thicker cortex (as a consequence of no synaptic pruning).

But not everything in this symposium resulted in bad news. A possible strategy to mitigate the effects of one frequent adversity trait, preterm birth, was described by Petra Huppi. It appears that music accompanying daily things such as waking up or being hungry was not only recognized by preterm babies, but also increased network connectivity as compared to a control group with the typical sounds and voices of an ICU. Similarly, Dr Vanderwert described the results of the BEIP study that aimed to compare children that had been institutionalized to children who were placed in foster care. EEG measures during the following 7-8 years showed that adopted children showed similar brain activation patterns to children that were never institutionalized, suggesting that institutional care is toxic to humans on brain development and that safe, predictable, individualized caregiving is one of the most powerful interventions available. Overall, this symposium emphasized the crucial role of early experiences and the potential for interventions to promote healthy brain development in the face of adversity.

The Neuroarcheology symposium's speakers described diverse strategies to study the emergence of human cognition. The challenge is big, so the studies are aiming to extrapolate the existence of structures or mechanisms based on fossils shapes, and brain activity in actual humans or non-human primates. In one unusual experiment, described by Sandrine Prat, experimental subjects had to imitate some technological movements from early hominins while performing EEG recordings, and results indicated no presence of complex cognition while performing these tasks.

In baboons, Dr Meguerditchian's team wondered whether the intentionality in gestures in nonhuman primates is associated to brain structures homologous to actual human language brain structures. Scanning some individuals, they observed activation of similar regions concluding that they have a long story in our brain circuits. Also related to language hardware, another viewpoint described by Dr Conde-Valverde was based on the reconstruction of hearing abilities from hominin fossils. New evidence suggests that the bandwidth of best acoustic sensitivity in ancient hominids was similar to contemporary human's, indicating that it is possible that not only Neandertals could speak, but that there also might be a common language based on the same sounds in both humanities.

Matthew Rushworth from Oxford University delivered an intriguing talk on the social brain. He highlighted the role of the dorsomedial frontal cortex in selecting and organizing information from the environment to elicit social behavior, which in turn guides our actions. Dr Rushworth presented findings from fMRI studies where participants had to choose objects on a screen by paying attention to either social cues or contextual cues. The results indicated that when faced with complex decisions, individuals tend to incorporate irrelevant social information, and this confusion is mediated by the dorsomedial prefrontal cortex, which appears to hold multiple types of information simultaneously. Interestingly, disruption of the intraparietal activation using transcranial ultrasound stimulation diminished the distracting effects of irrelevant social information during decision-making tasks.

In another paper presented during the talk, the researchers aimed to understand how the brain supports context-dependent social judgment. They investigated how individuals represent multidimensional traits of others and how the brain extracts relevant information while filtering out irrelevant details during social comparisons. Through human fMRI studies, distinct neural representations in the dorsomedial prefrontal cortex (dmPFC) and anterior insula (AI) were identified, supporting the separation and selection of information for context-dependent social judgment. Furthermore, causal evaluation using non-invasive brain stimulation demonstrated that disrupting the anterior insula altered the impact of relevant information on social comparison, while disrupting the dmPFC affected the impact of irrelevant information. This neural circuit involved in context-dependent social judgment

differs from the one responsible for integrating different features in a multidimensional cognitive space.

Matthew Rushworth's talk provided insights into the neural mechanisms underlying social cognition and decision-making. The dorsomedial prefrontal cortex emerged as a key region involved in integrating and processing social information, even when it may be irrelevant to the task at hand. The research also shed light on how the brain separates and selects information based on the context, contributing to our understanding of how individuals make social judgments and navigate complex social interactions.

In conclusion, NeuroFrance 2023 was a highly engaging and informative conference that encompassed a wide range of topics in neuroscience. The symposium on early experiences and adversity underscored the importance of early development in shaping brain function and emphasized the potential for interventions to support healthy brain development in the face of adversity. The Neuroarcheology symposium offered intriguing insights into the emergence of human cognition and language, drawing from various approaches such as fossil analysis and brain imaging. Lastly, Matthew Rushworth's talk on the social brain provided valuable insights into the neural mechanisms underlying social cognition and decision-making. Overall, the conference showcased the ongoing advancements in cognitive neuroscience and highlighted the collaborative efforts of researchers to unravel the mysteries of the human brain.

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Melina Vladisauskas is from Universidad Torcuato di Tella. She wrote this meeting report as part of the Tianqiao and Chrissy Chen Institute Science Writers Fellowship which aims to extend the conversation beyond the meeting with the hopes of sparking new ideas and collaborations.